Falling Creek Reservoir Volunteer Monitoring

Data Summary 2003

Falling Creek Reservoir Preservation Society Meeting
February 5th 2004

To be responsible protectors of the environment

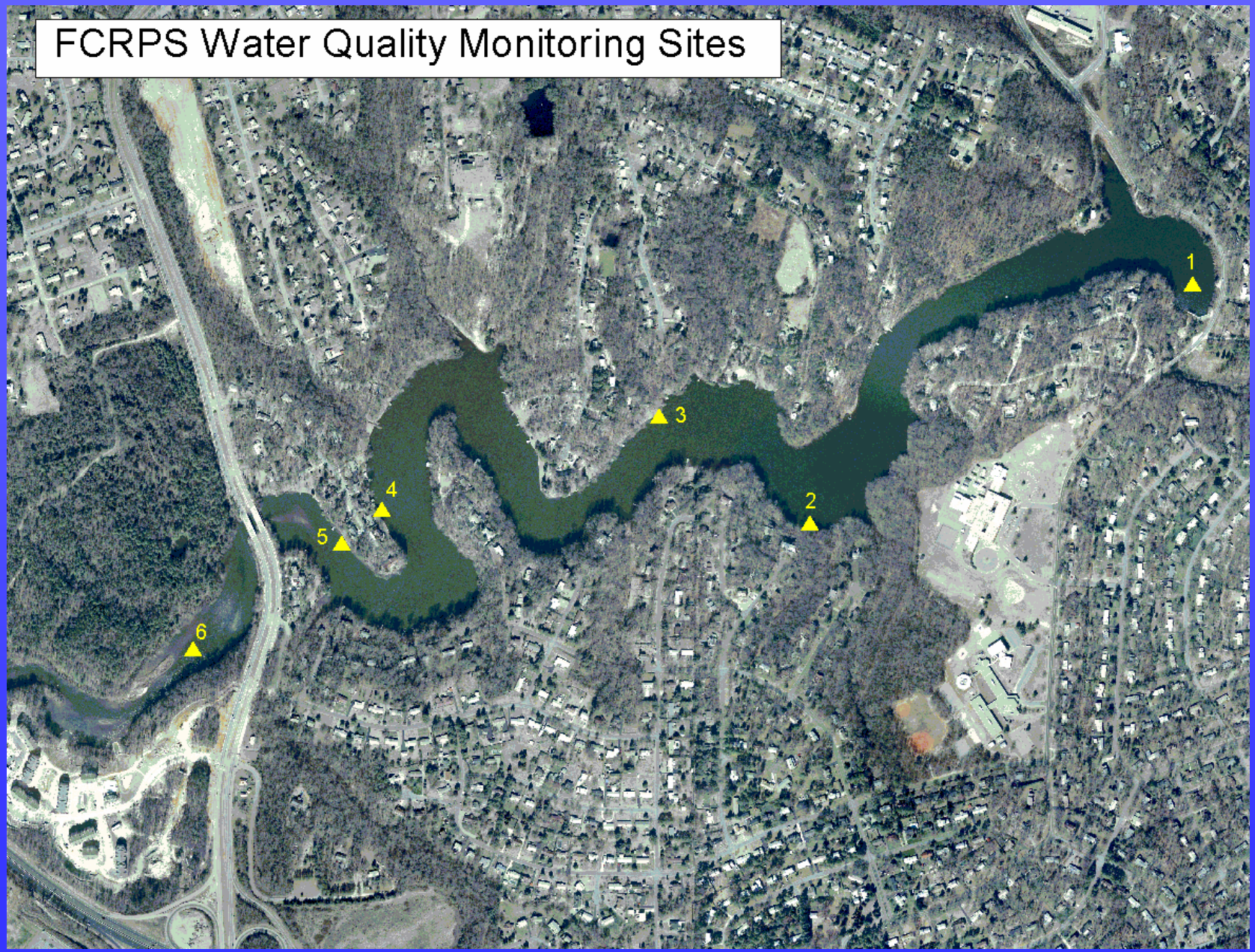
Timeline 2003

- January: Volunteer Program guide completed
- March: Met with FCRPS to present program
- April: Evening meeting to select sites and distribute kits
- April: Monitoring commenced
- May: Volunteer Coordinator starts
- June: Reservoir cleanup event
- October: Volunteer training day
- December: FCRPS wraps up first year of sampling

Program Facts and Figures

- Six sites
- April - December
- 9 volunteer monitors
- 14 monitoring events
- 74 individual samplings
- 369 in-field measurements
- 296 laboratory determinations
- 665 total tests

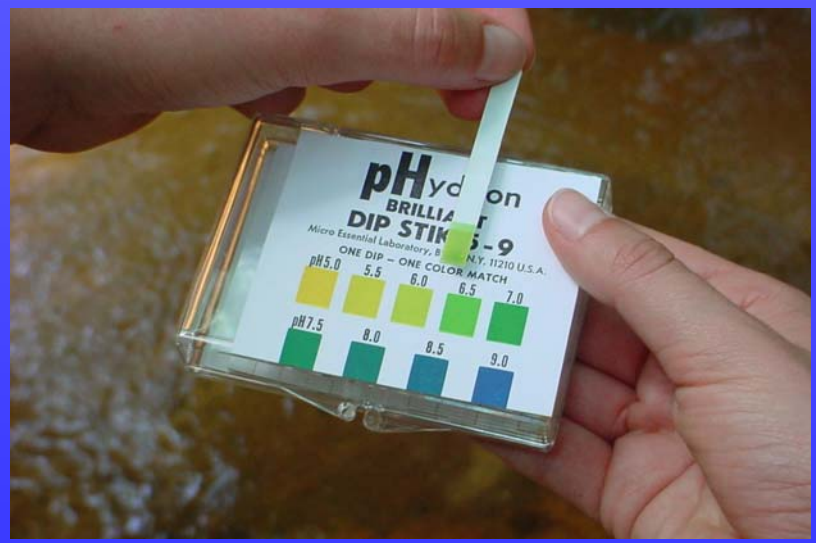
FCRPS Water Quality Monitoring Sites



To be responsible protectors of the environment

Sampling Protocol

- Selected sites spanned the entire reservoir
- Sampling occurred twice monthly during growing season (May – October) and monthly for the remainder of the year
- Grab samples of surface waters of the reservoir



Parameters

In lake measurements

- Secchi Depth
- pH
- Temperature
- Depth

Laboratory analyses

- Ammonia Nitrogen
- Nitrite Nitrogen
- Nitrate/Nitrite Nitrogen
- Phosphate Phosphorus

Observations

- Majority of monitoring occurred on sunny days with light winds and relatively calm waters
- Water Color: various shades of brown
- Water Odors: 76% “None”, 15% “Earthy”, 7% “Fishy”, 1% “Other”
- Biota: algae, macrophytes, insects, fish, waterfowl and a beaver
- Garbage, leaves and debris were frequently reported with occasional dead fish and algae clumps noted

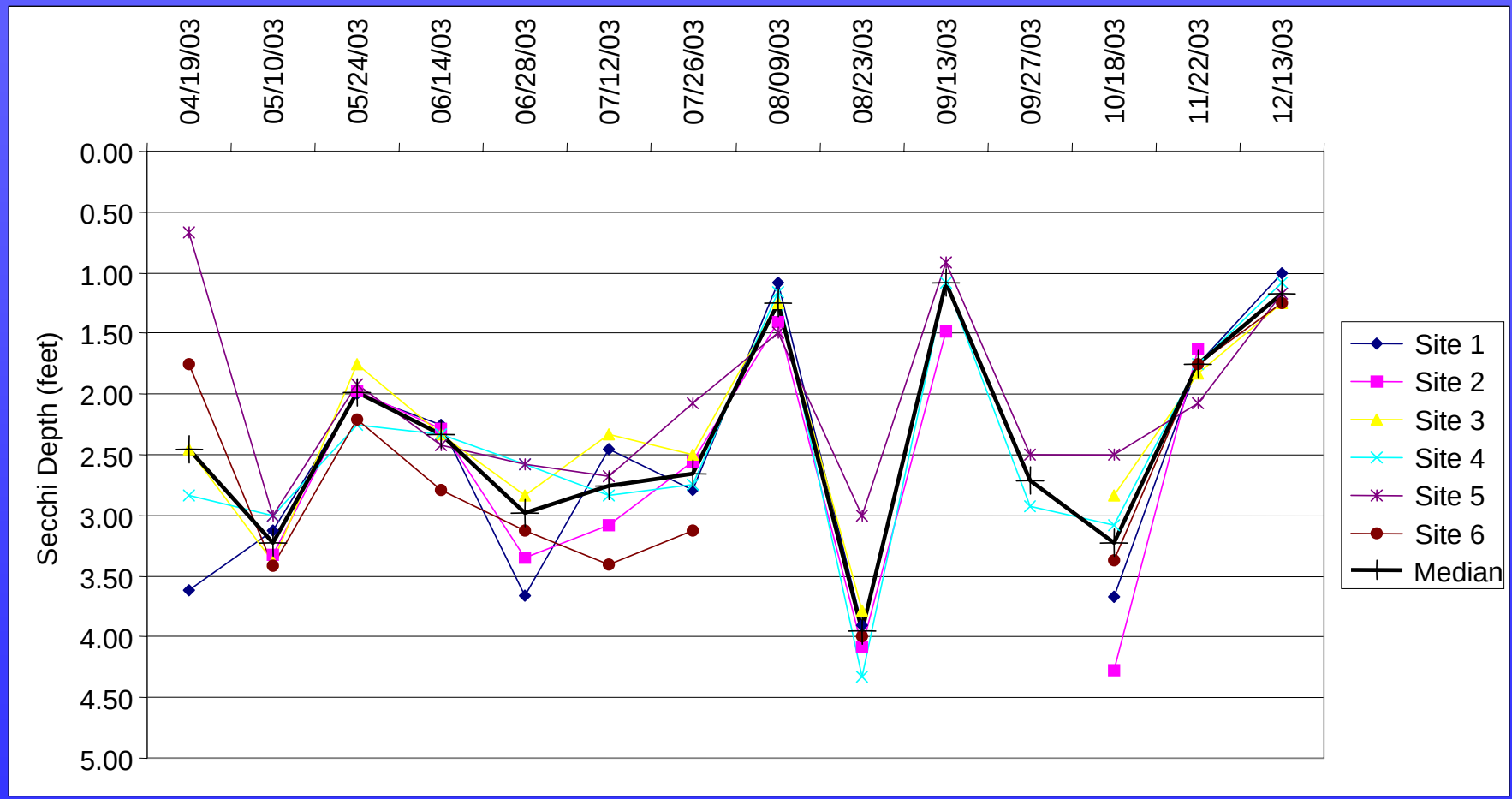
Annual median values for all volunteer observations in Falling Creek Reservoir 2003

Parameter	Unit	Annual in-Lake Median
Secchi Depth	feet	2.5
Surface Temperature	^{o}C	23
Surface pH	units	6.0
Water Depth	feet	5.5
Ammonia	mg/L as N	0.03
Nitrite	mg/L as N	0.01
Nitrate	mg/L as N	0.14
Nitrate+Nitrite	mg/L as N	0.15
Phosphate Phosphorus	mg/L as P	0.02
Air Temperature	^{o}C	24

Secchi Depth

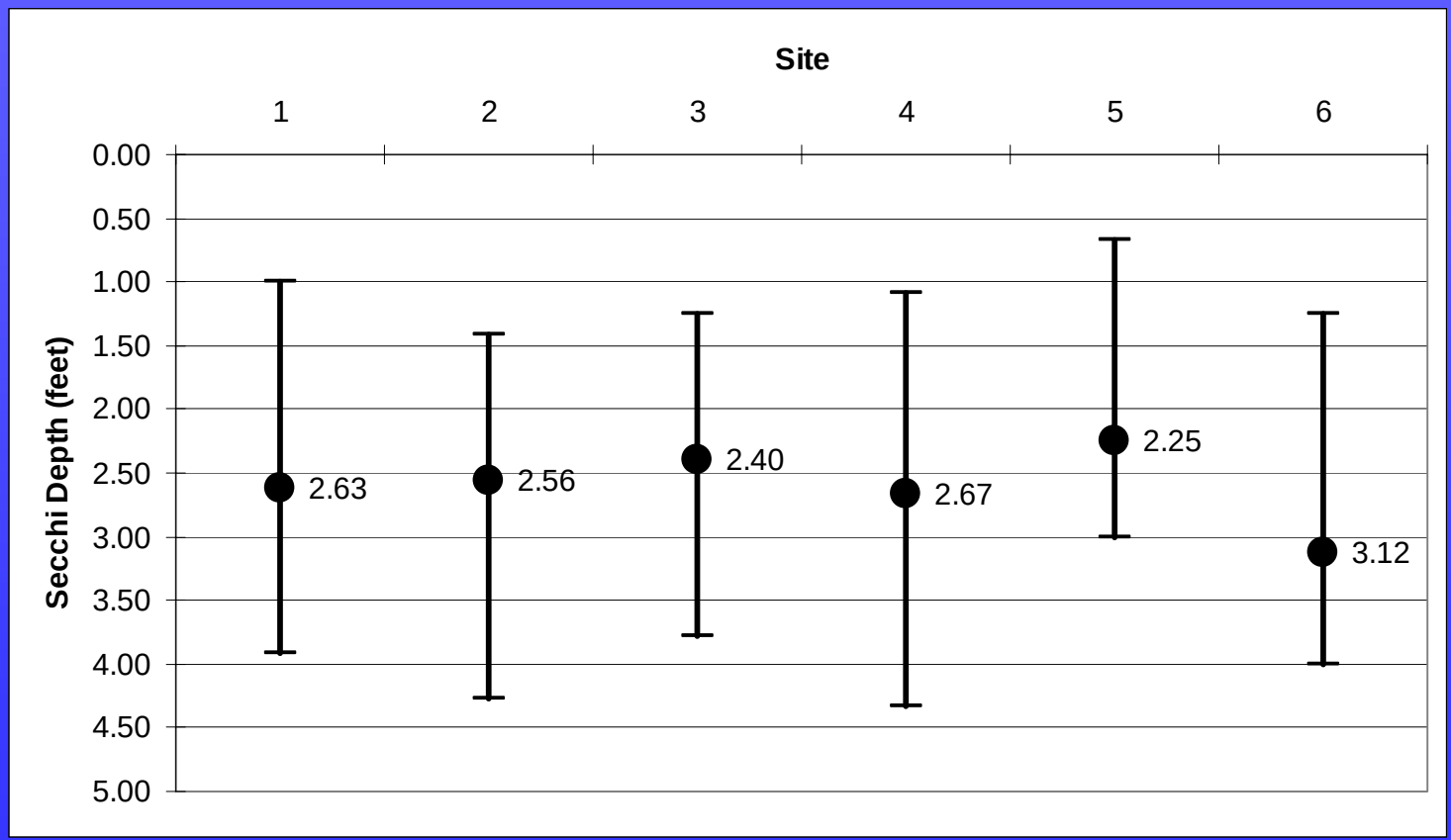
- Developed in 1865 by Fr. Pietro Angelo Secchi
- Basic measure of water clarity
- USEPA Ecoregion IX median Secchi Depth is 4.25 feet

Secchi Depths



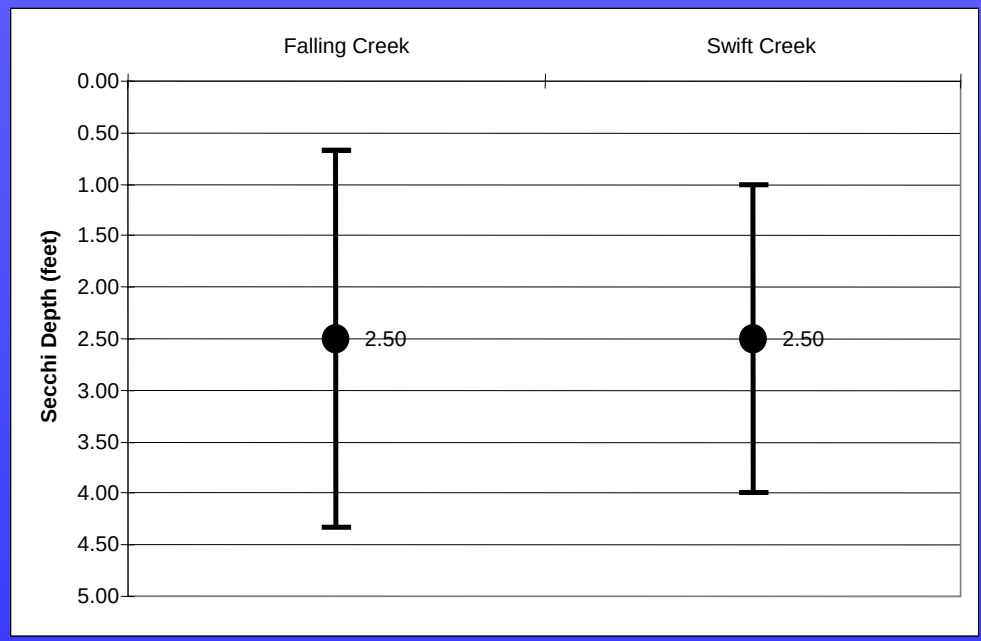
To be responsible protectors of the environment

Annual site medians and ranges of Secchi Depth observations, 2003.



Statistical Comparison to Swift Creek Reservoir

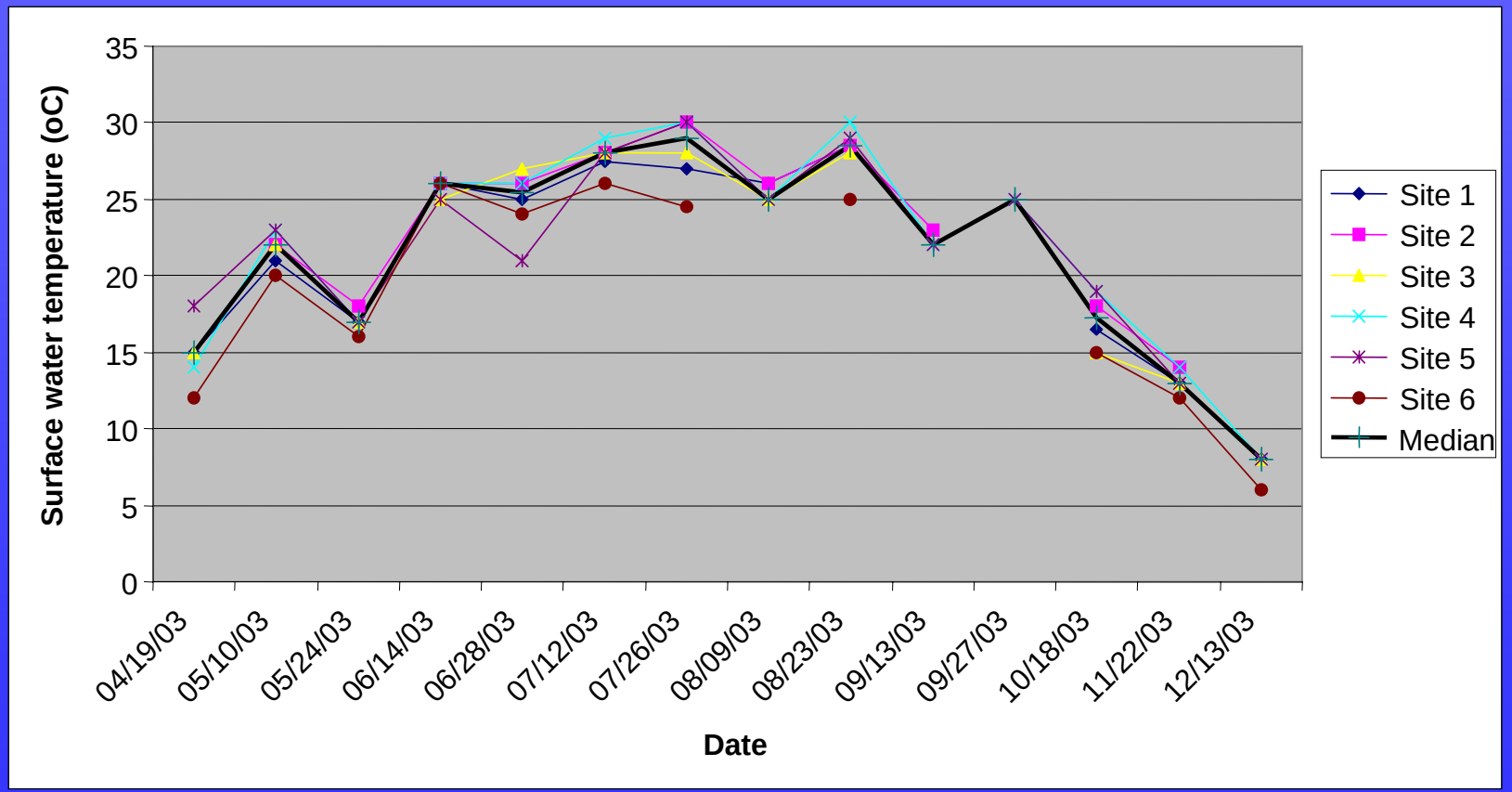
- Used students t-test for unequal variances
- No statistical differences between Falling Creek Secchi Depths and Swift Creek Secchi Depths



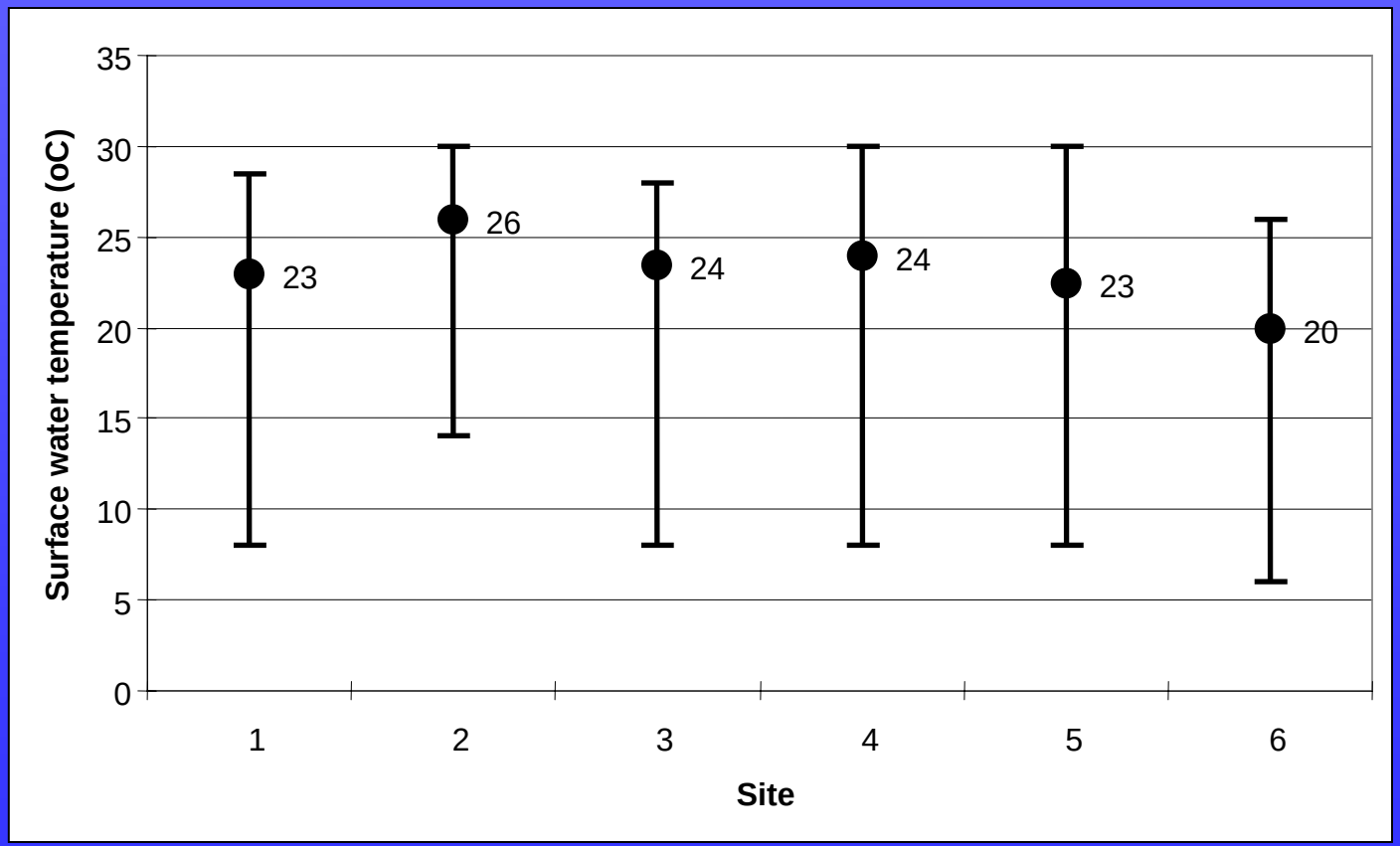
Temperature

- Basic water quality measurement
- Virginia State Surface Water Quality Standard states temperature should not exceed 32°C (90°F)
- Potential sources of elevated temperatures are industrial discharges, power plant cooling effluent or runoff from paved surfaces

Surface water temperatures in Falling Creek Reservoir, 2003

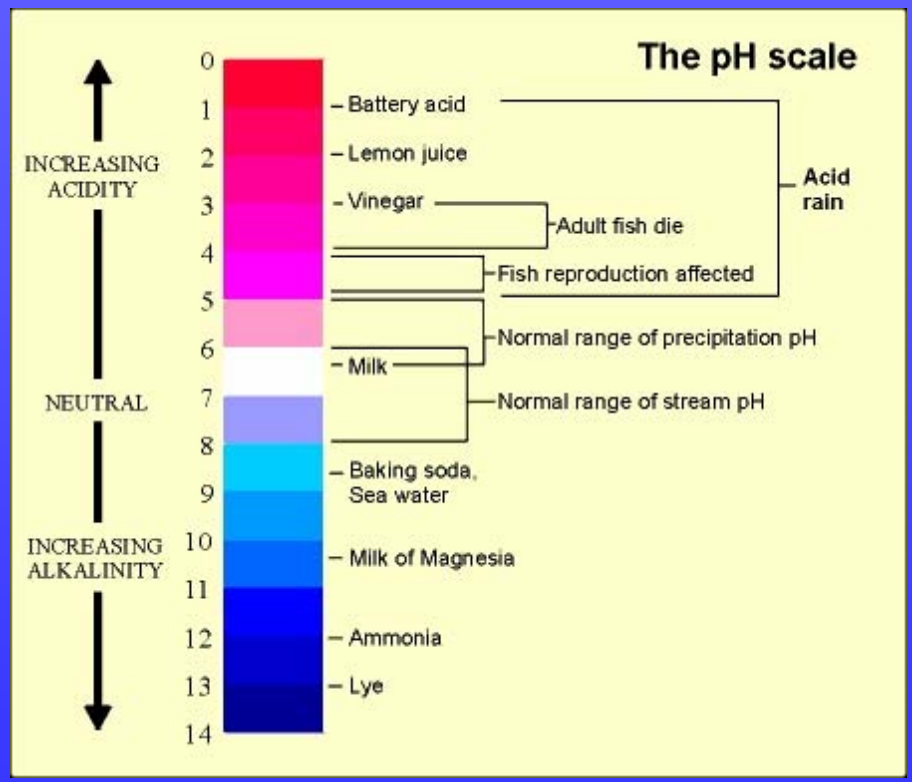


Annual site medians and ranges of surface water temperatures observed in Falling Creek Reservoir, 2003

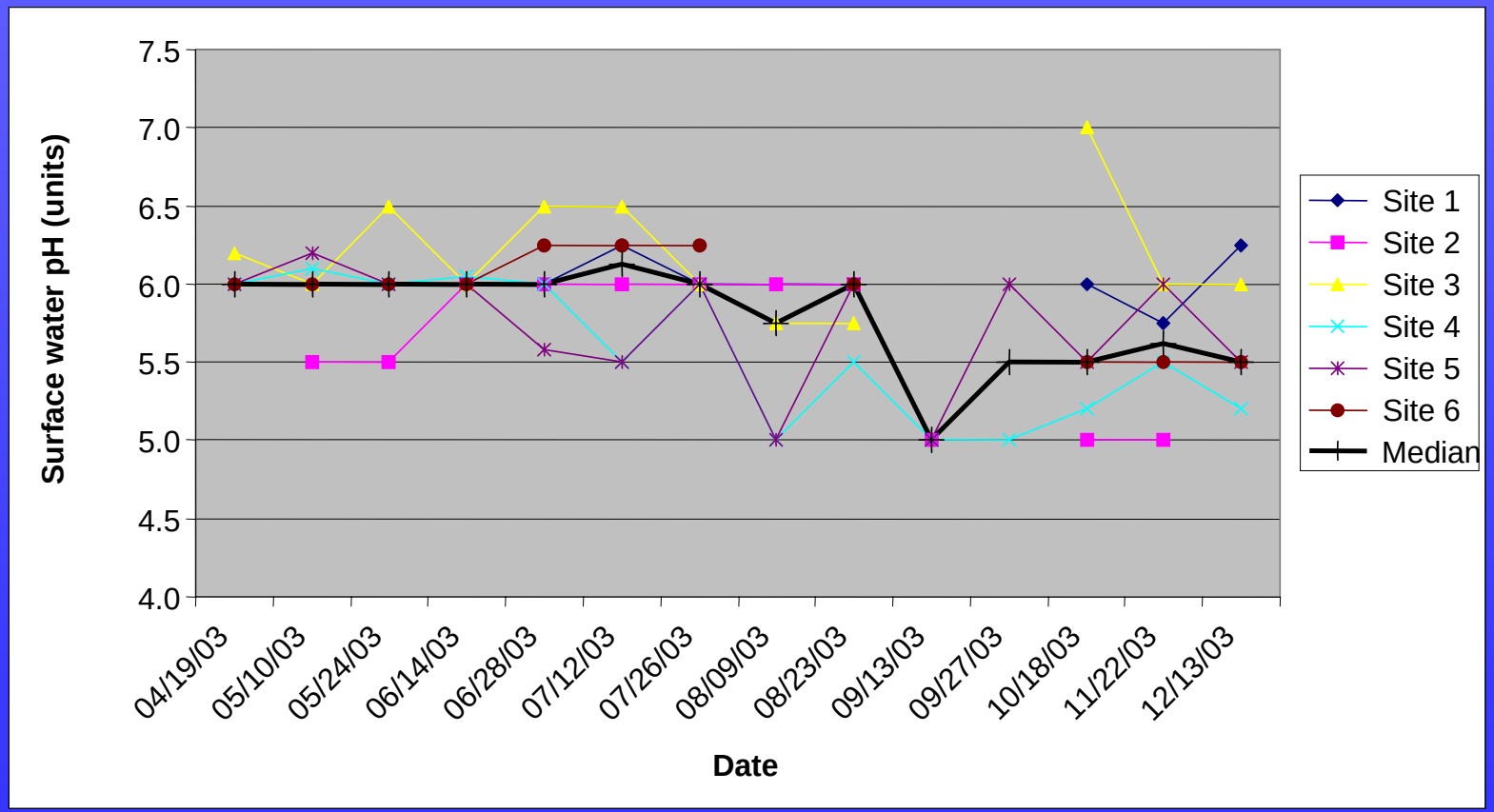


pH

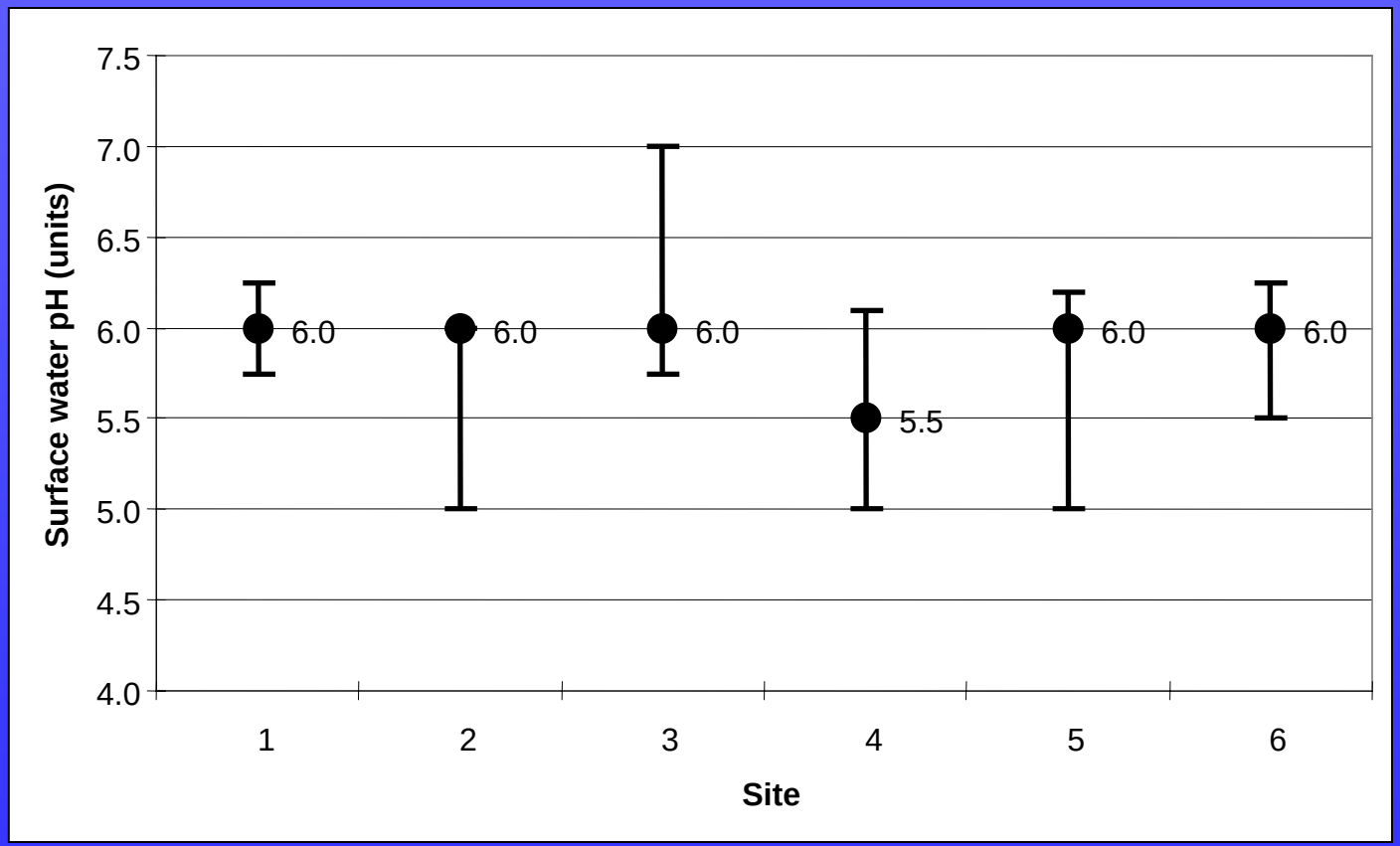
- Measure of acidity or alkalinity of the water; expressed as “units”
- Virginia State Surface Water Quality Standard is 6.0 – 9.0 units
- Affected by geology, rainfall, leaf litter input, algal activity or point discharges



Surface water pH observations in Falling Creek Reservoir, 2003



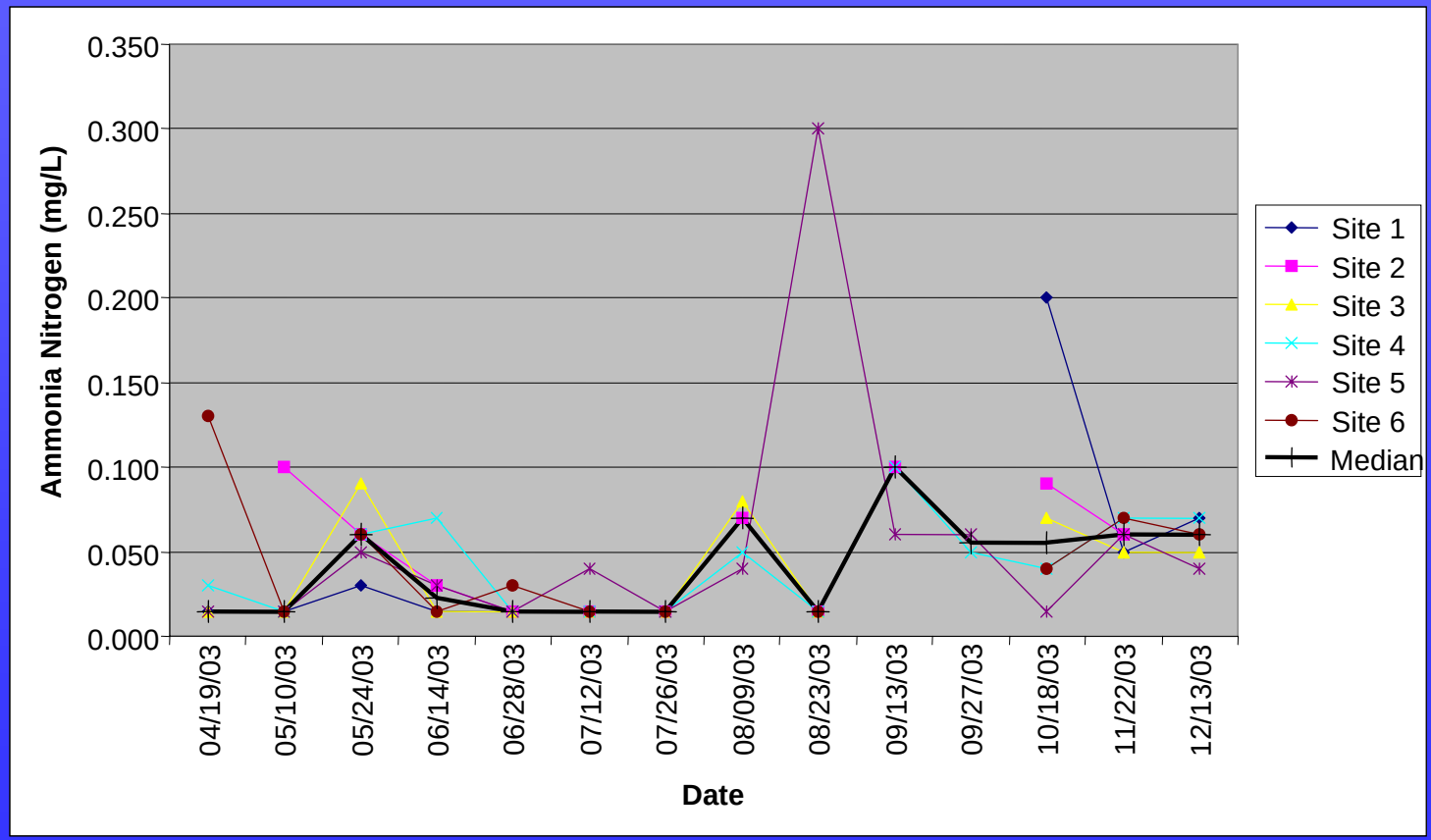
Annual site medians and ranges of surface water pH observations in Falling Creek Reservoir, 2003



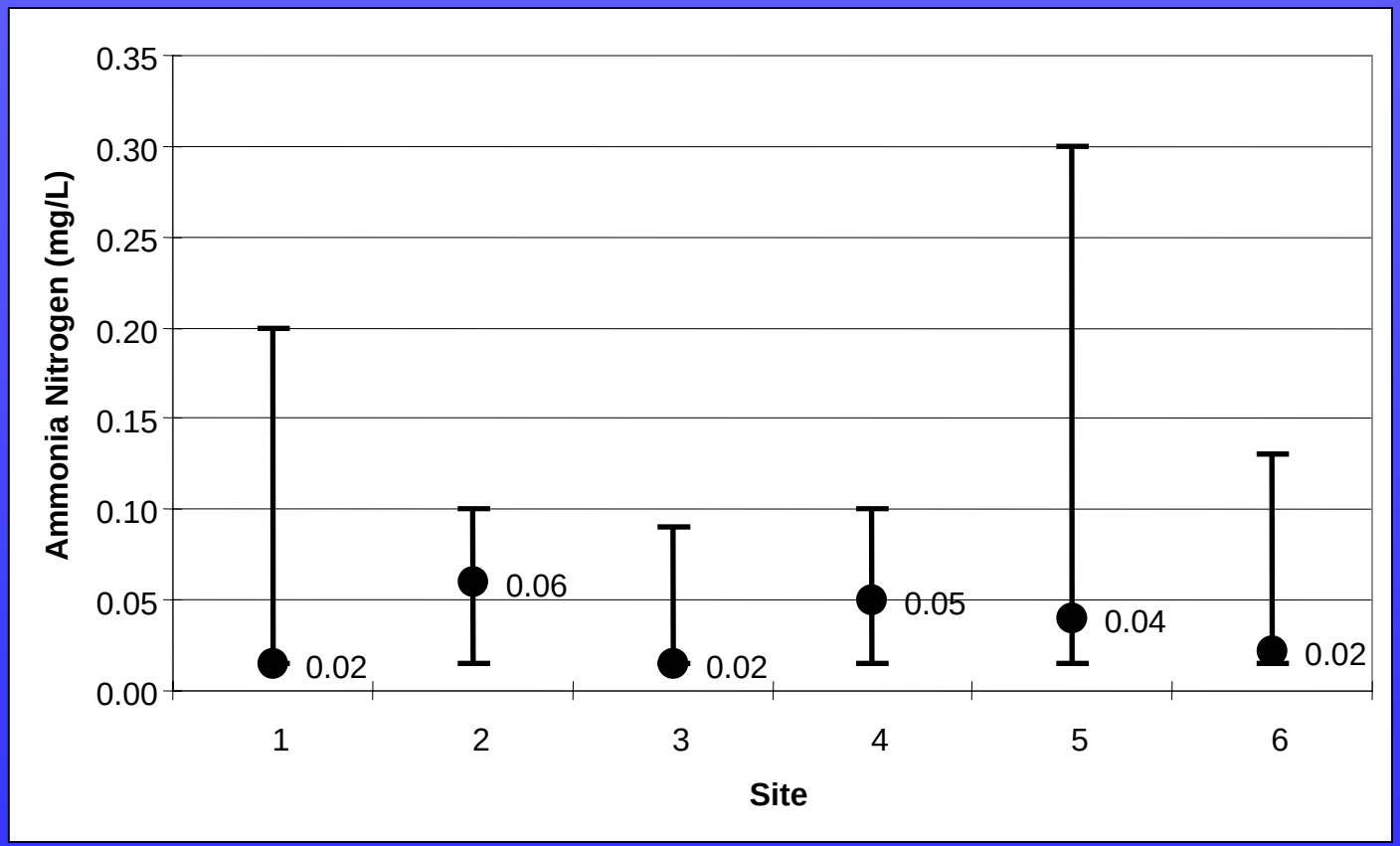
Ammonia Nitrogen

- An inorganic dissolved form of nitrogen; a nutrient for plant growth
- Prevalent in areas of low dissolved oxygen
- Toxicity to aquatic life is dependent on pH and temperature (high pH and warm temperatures increase toxicity)
- Sources include fertilizers, human and animal wastes, industrial effluents

Ammonia Nitrogen observations in Falling Creek Reservoir, 2003

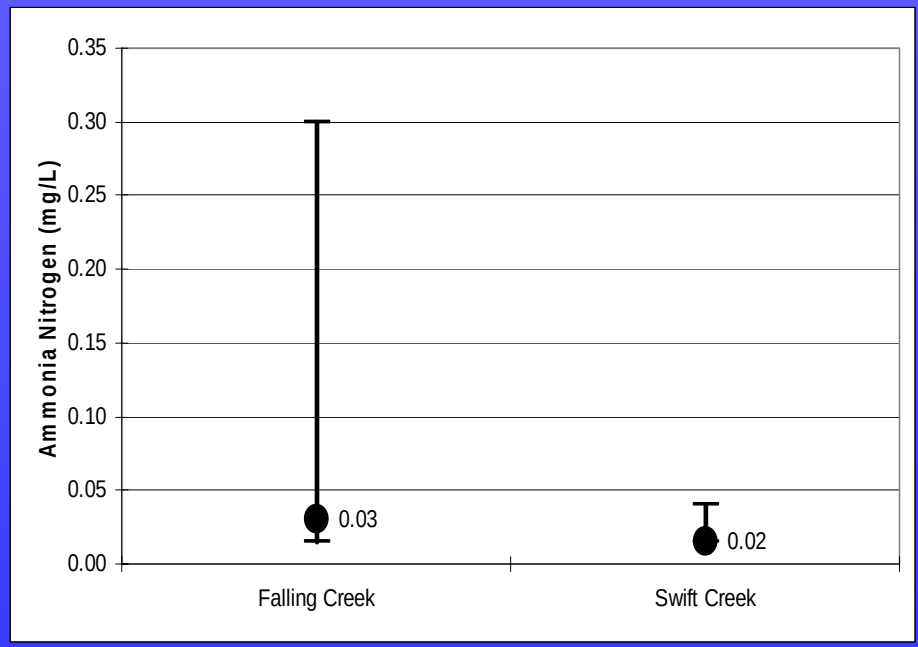


Annual site medians and ranges of Ammonia Nitrogen observations in Falling Creek Reservoir, 2003



Statistical Comparison to Swift Creek Reservoir

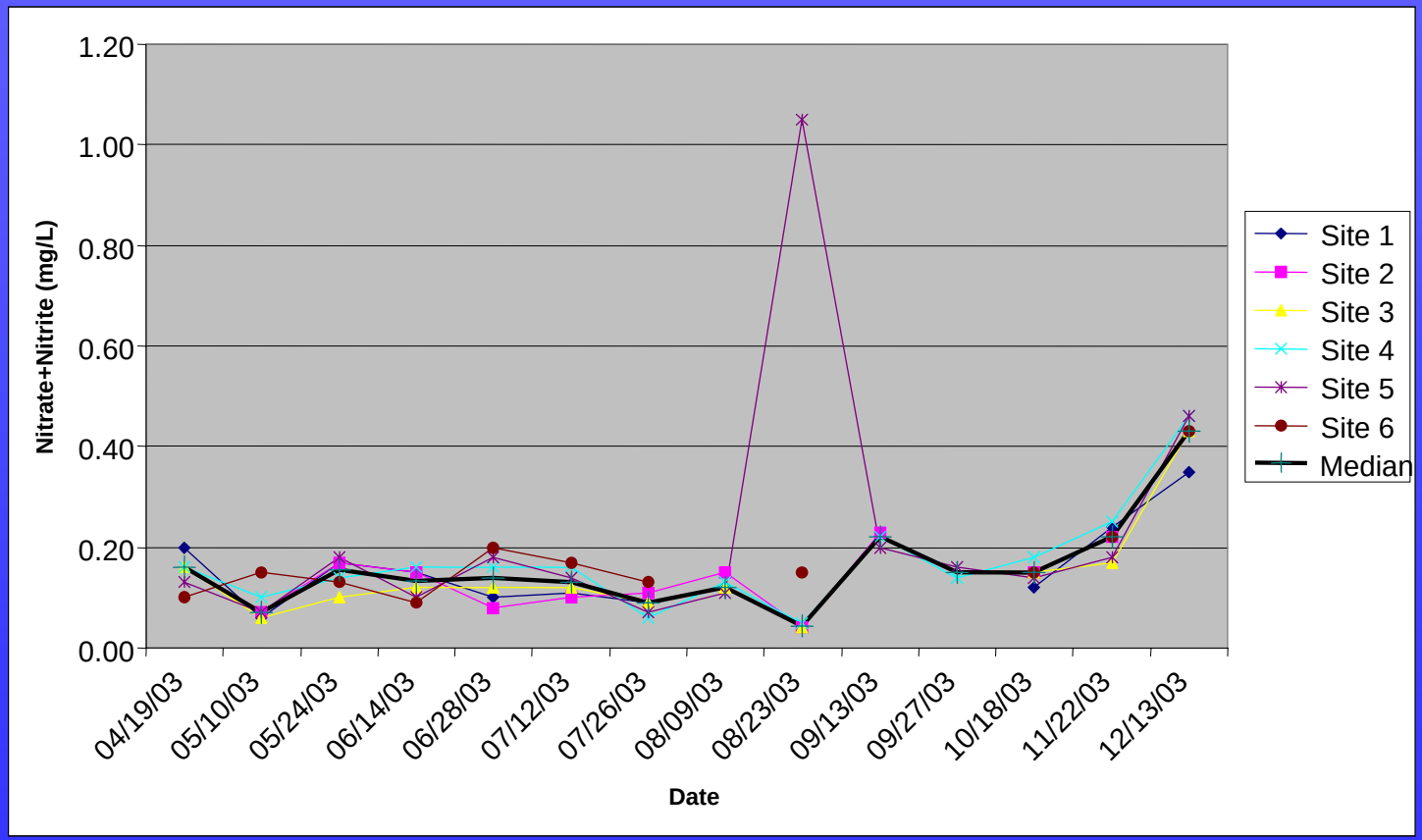
- Used students t-test for unequal variances
- Falling Creek ammonia nitrogen concentrations are significantly greater than those observed in Swift Creek Reservoir



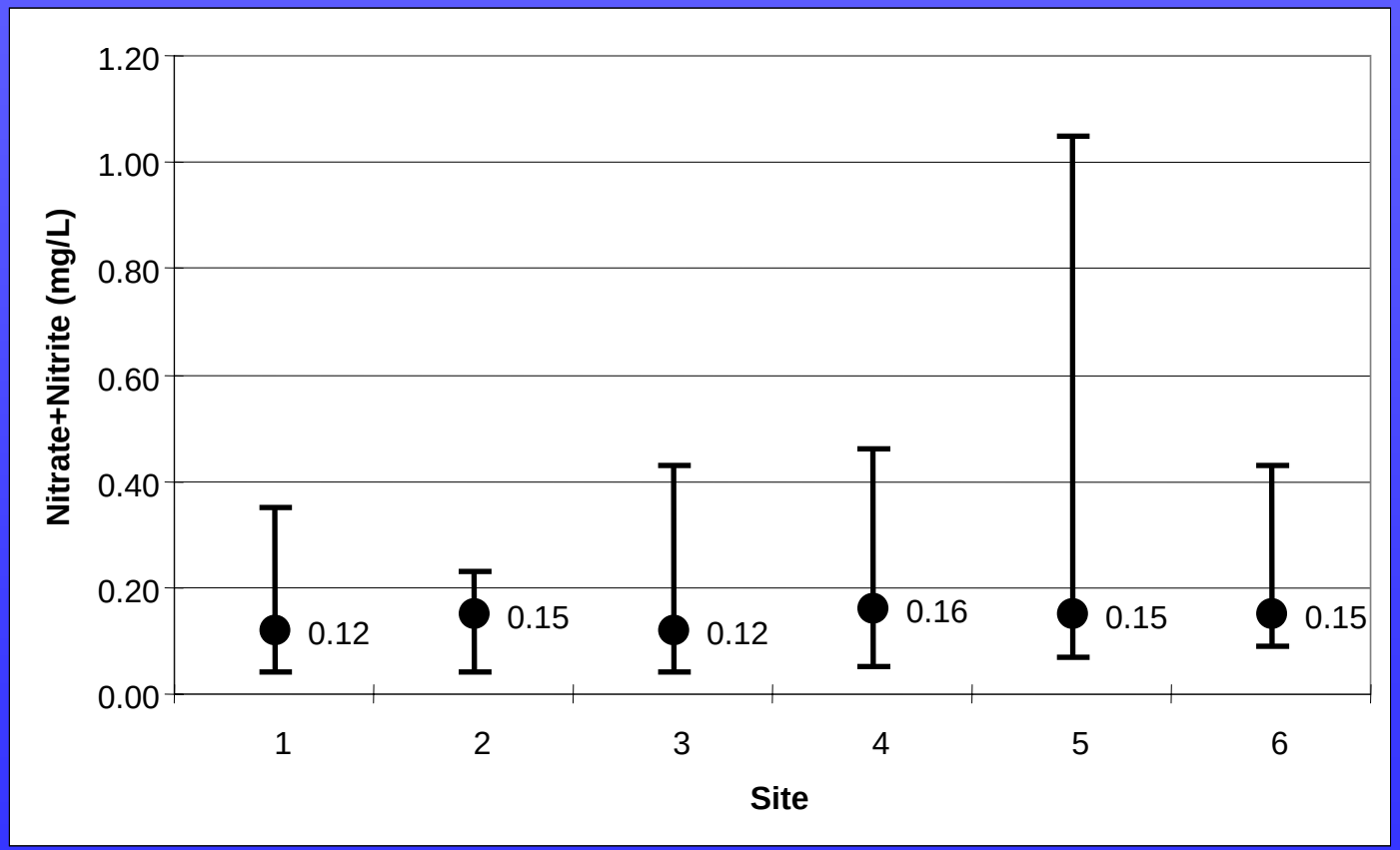
Nitrate+Nitrite

- An inorganic dissolved form of nitrogen; a nutrient for plant growth
- Excessive concentrations lead to *eutrophication*
- USEPA Ecoregion IX measurements ranged from 0.00 – 1.32 mg/L
- Sources include fertilizer runoff, failing onsite septic systems and industrial effluents

Nitrate+Nitrite Nitrogen observations in Falling Creek Reservoir, 2003



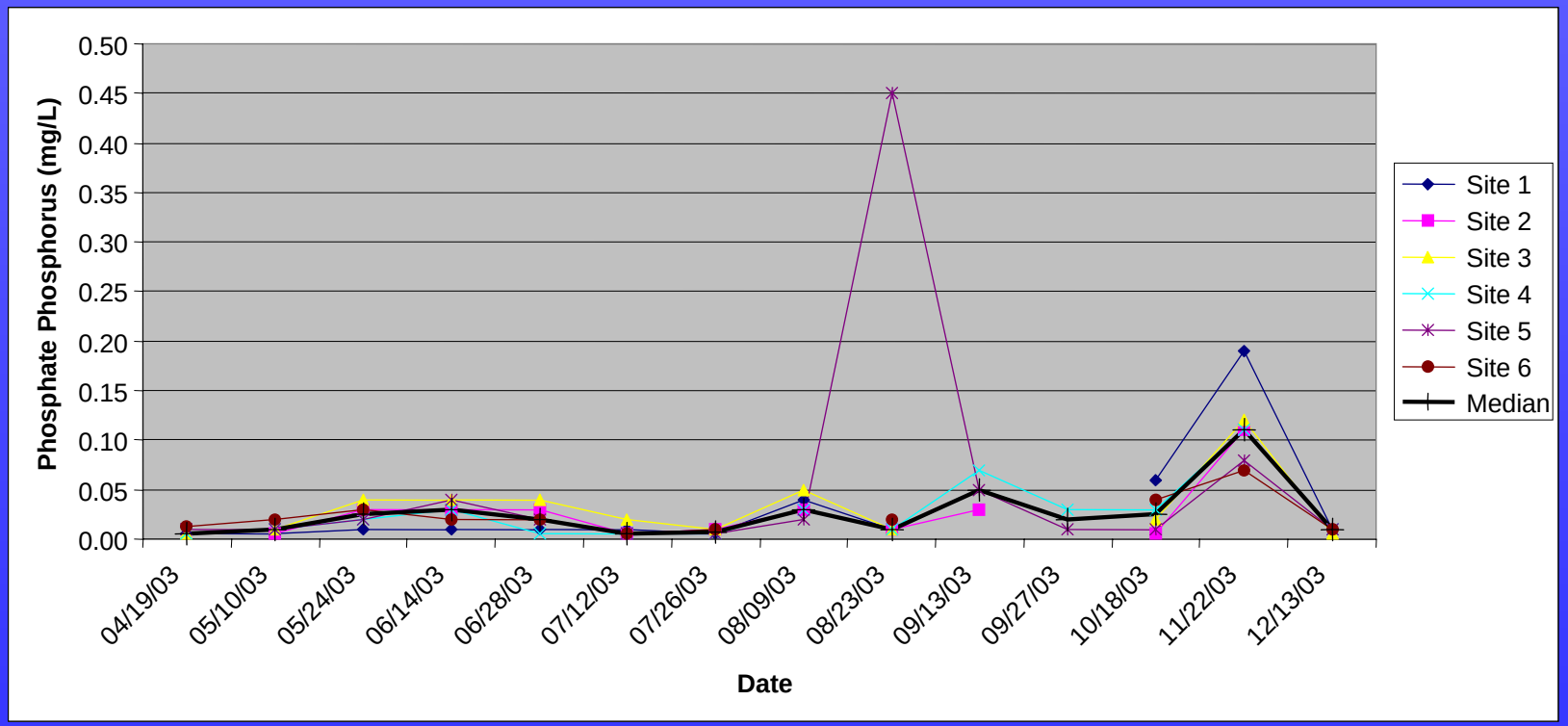
Annual site medians and ranges of Nitrate+Nitrite Nitrogen observations in Falling Creek Reservoir, 2003



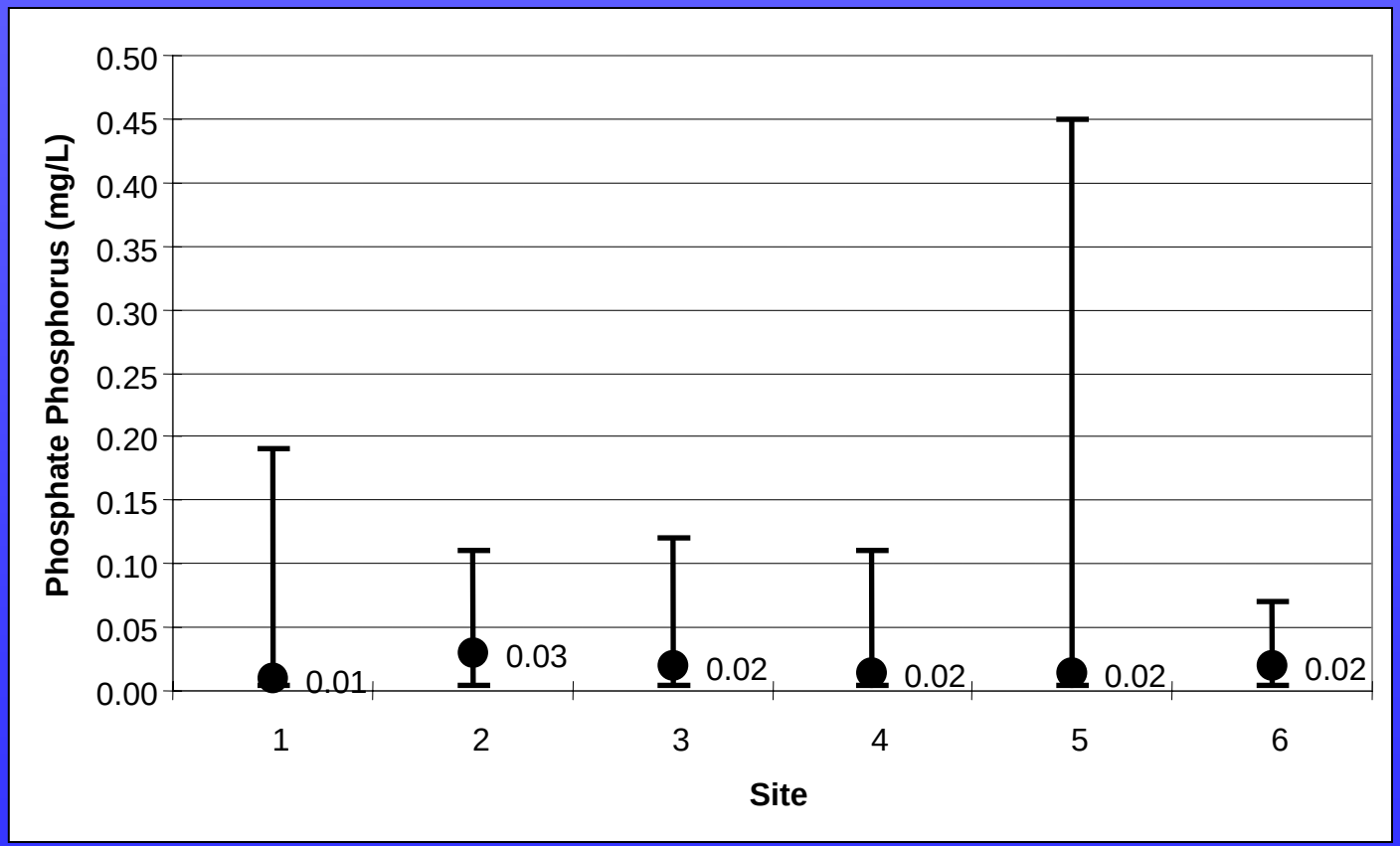
Phosphate Phosphorus

- An inorganic dissolved form of phosphorus; a limiting nutrient for plant growth
- Levels as low as 0.01 mg/L can sustain increased algae productivity
- Sources include fertilizer runoff, failing onsite septic systems, decaying plants and animals and industrial effluents

Phosphate Phosphorus observations in Falling Creek Reservoir, 2003



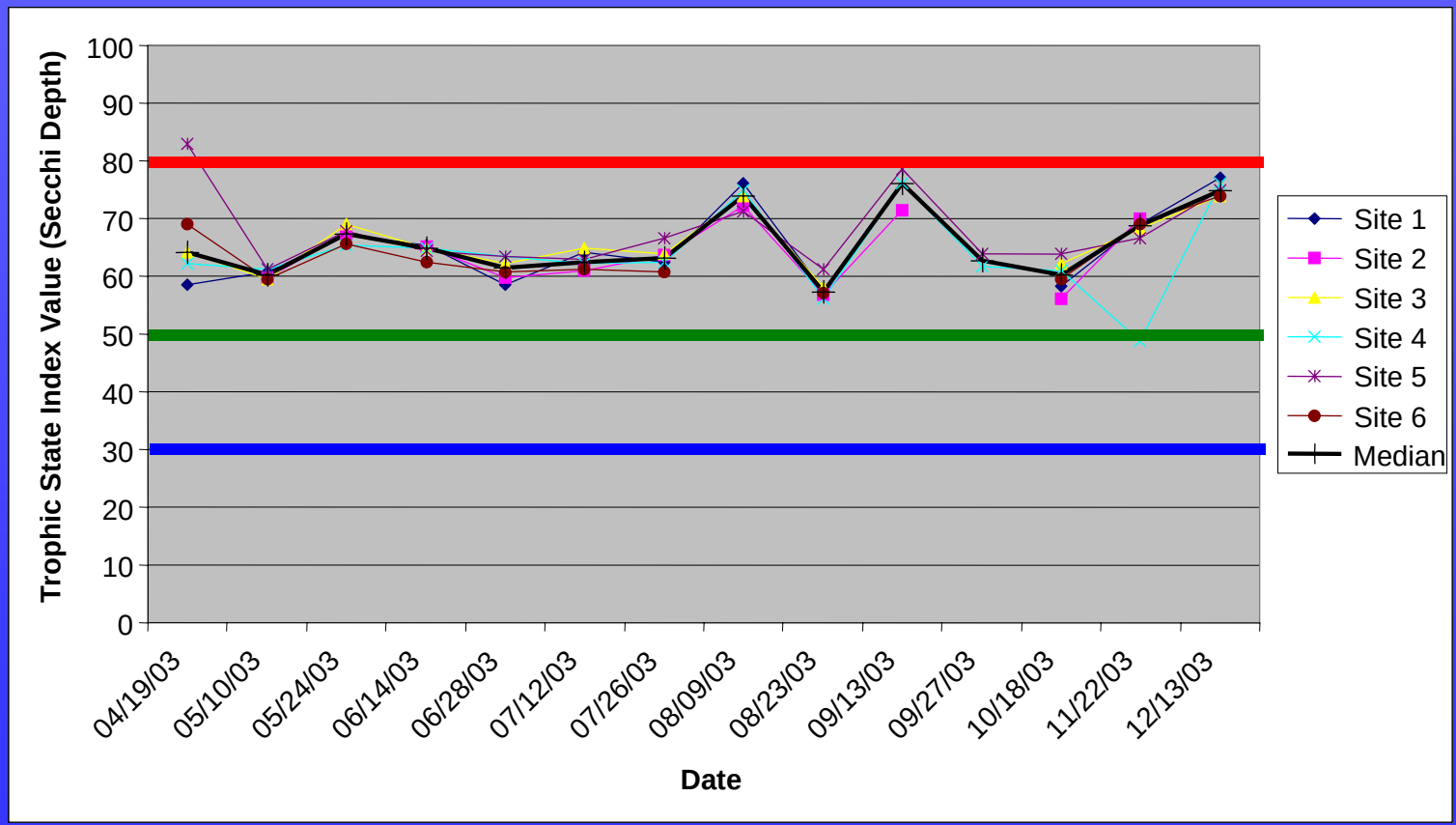
Annual site medians and ranges of Phosphate Phosphorus observations in Falling Creek Reservoir, 2003



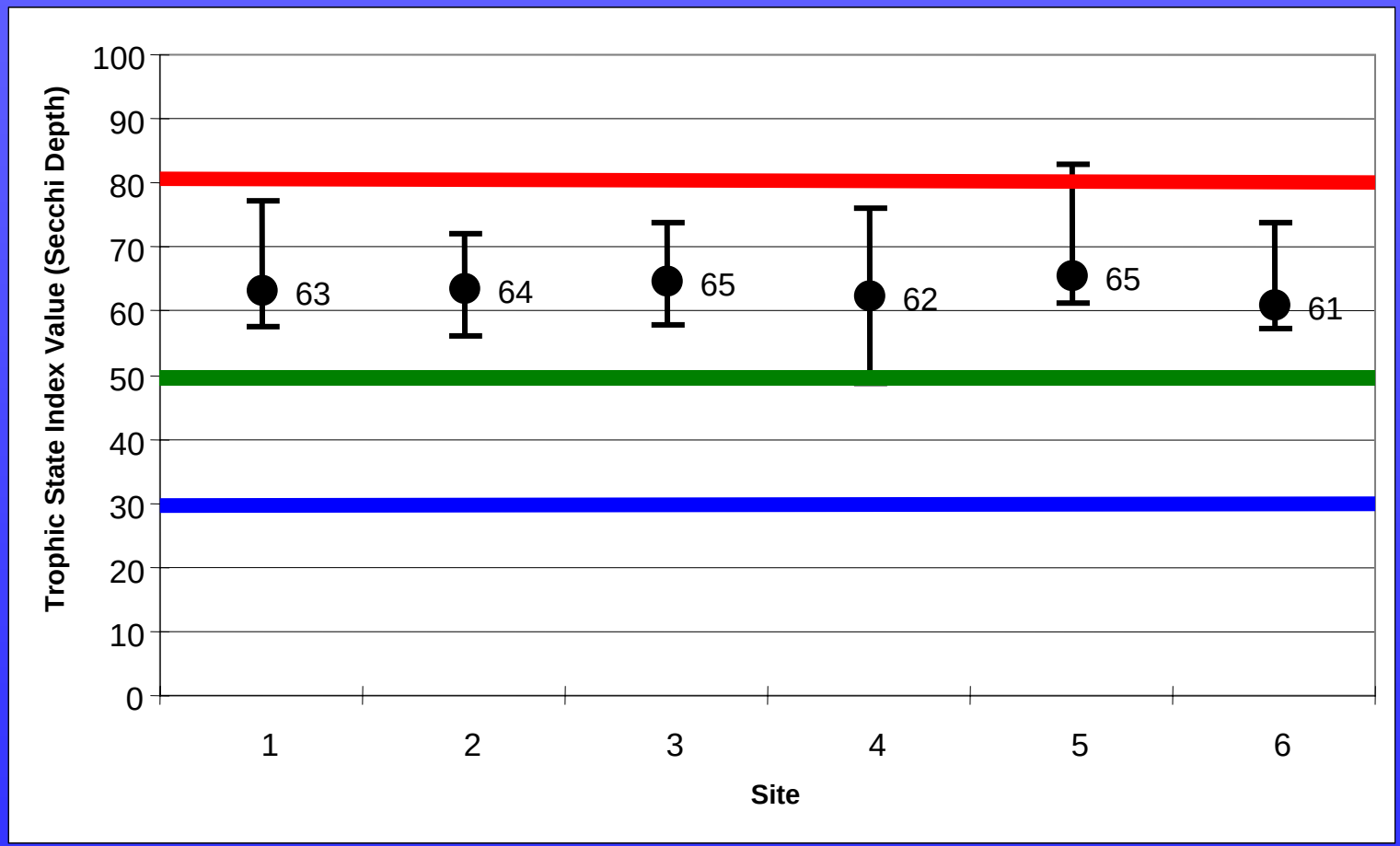
Trophic State

- A measure of a lake's biological productivity
- *Eutrophication*: The process by which lakes become enriched by nutrients (phosphorus and nitrogen). Leads to excessive plant growth, lack of oxygen and loss of the lake as a viable aquatic resource
- *Oligotrophic*: Very unproductive; lakes low in nutrients and algae, waters are usually very transparent
- *Mesotrophic*: Moderately productive
- *Eutrophic*: Very productive; lakes high in nutrient concentrations and algae; lakes typically are shallow with algae blooms and periods of oxygen deficiency. Slightly or moderately eutrophic water can be healthful and support a complex web of plant and animal life

Carlson's Trophic State Index for Secchi Disk Depth, 2003. Red = upper boundary of eutrophy; Green= upper boundary of mesotrophy; Blue = upper boundary of oligotrophy.



Annual site medians and ranges of Carlson's Trophic State Index for Secchi Disk Depth, 2003. Red = upper boundary of eutrophy; Green= upper boundary of mesotrophy; Blue = upper boundary of oligotrophy



Conclusions

- Falling Creek Reservoir exhibits generally good water quality
- Increased concentrations of nutrients observed in the autumn; may be related to fall fertilizing in the watershed
- Moderately eutrophic body of water

Goals for 2004

- Continue with current sampling regime
- Addition of dissolved oxygen testing
- Addition of turbidity
- Quarterly samples for total phosphorus and chlorophyll *a*
- Seek grant funding to broaden the program

Data resources available from other agencies

- Virginia Department of Environmental Quality: Conducted comprehensive physical and chemical monitoring from April through October of 2003. Also historical data available for 1980, 1989 and 1994 *https://www.deq.state.va.us/webapp/wqm_station.station_detail?p_sta_id=2-FAC003.85*
- Chesterfield County Department of Utilities: Has monitored Fecal Coliform levels at three sites since 1990
- Draper Aden Associates, 2003*: Royal Oaks Development Falling Creek Reservoir Post Development Water Quality Study*
- KCI Technologies, Inc: Has been contracted to conduct a dredging feasibility study. Currently is working on stream restorations in the Falling Creek Reservoir Watershed (Upper Falling Creek and Pocoshock Creek)
- Chesterfield County Office of Water Quality

Volunteer Monitors

- May & Phil Thomas
- Sandra (Sandy) Venegoni
- Bee Lewis
- James Carlson
- William (Bill) Melnizek
- Janet Bell
- Jerry Bullifant
- Miles Turner